California Division of Mines and Geology

Fault Evaluation Report FER-89

April 20, 1979

1. Name of fault

Earthquake Valley and San Felipe Valley faults.

2. Location of faults

Earthquake and San Felipe Valleys, eastern San Diego County, California.

3. Reason for evaluation

This area lies within the 1978 study area of the 10-year program for fault evaluation.

4. List of references

Clark, M.M., 1978, Map of the Elsinore and Earthquake Valley faults, San Diego and Imperial Counties, California. Unpublished work in progress.

Dibblee, T.W., Jr., 1944, Geologic map of the Borrego quadrangle, San Diego County, California. Unpublished map, U.S. Geological Survey.

Jennings, C.W., 1975, Fault map of California with locations of volcanoes, thermal springs, and thermal wells: California Division of Mines and Geology, California Geologic Data Map Series, Map No. 1, Scale 1:750,000.

Merriam, R.H., 1958, Geology of Santa Ysabel quadrangle, San Diego County, California: California Division of Mines Bulletin 177, p. 7-21, 2 plates.

Real, C.R., Parke, D.L., and Toppozada, T.R., 1978, Magnetic tape catalog of California earthquakes, 1900-1974: California Division of Mines and Geology.

Weber, F.H., Jr., 1963, Geology and mineral resources of San Diego County, California: California Division of Mines and Geology County Report 3, 309 p.

Aerial Photography

Designation: Fairchild C-15152
Date: April 21, 1950
Scale: 1:26,000
Type: black and white, vertical stereo
Coverage: Elsinore fault, southeastward from Mason Valley to the Mexican border.
Availability: Fairchild aerial photo collection, Geology Department, Whittier College, Whittier, California.

Designation: Navy COP
Date: 1954
Scale: 1:37,333
Type: black and white, vertical stereo
Coverage: Elsinore and Earthquake Valley faults in the Julian, Earthquake Valley, and Monument Peak quadrangles.
Availability: San Francisco District Office, California Division of Mines and Geology, San Francisco.

5., 6., and 7. Summary of available data, interpretation of aerial photography, and field observations.

The Earthquake Valley and San Felipe Valley faults are very nearly one continuous fault, although on close inspection (figure 3), there is a suggestion that the San Felipe Valley fault branches from the Earthquake Valley fault. Both faults form the boundary between the valleys to the southwest and the low mountains to the northeast. The relative straightness of the fault traces suggests that the faults are high angle. None of the workers in this area (including myself) have observed the attitude of the fault, or, if they did, they did not record it on their maps. The small segment of thrust fault shown near the head of Sentenac Canyon is apparently only a secondary feature--the result of compressive stresses generated by a left step on a right-lateral strike-slip fault. Note that the Earthquake Valley fault shifts about one kilometer to the left in the vicinity of Sentenac Canyon.

Dibblee (1944) and Merriam (1958) mapped these faults on 15-minute quadrangles at a scale of 1:62,500. Their mapping of the fault traces is very generalized and of limited accuracy. Clark (1978) mapped the geomorphic features along these faults and the writer, along with Earl Hart of the California Division of Mines and Geology, did some additional mapping and field checking in February of 1979. The mapping of Clark, and myself and Hart, is compiled onto figure 3. My evaluation of these faults is based on the mapping shown on figure 3. In the discussion that follows, the Earthquake Valley and San Felipe Valley faults are

considered separately.

Earthquake Valley fault

This fault has a recognizable length of about 12.5 km. The northwestern-most 1.5 km is characterized mainly by a prominent vegetation lineament, almost certainly the result of an underlying ground water barrier. This feature is represented, on figure 3, by a long solid line near the southeastern corner of the Ranchita quadrangle. There is some suggestion for Holocene activity along this segment. There is a difference of slope on the alluvial surface on opposite sides of the fault, the southwestern side sloping more steeply to the southwest. This surface is probably as young as Holocene age, and the differences in slope may represent deformation resulting from Holocene fault movement. At the southeastern end of this segment, near the boundary between the Ranchita and Julian quadrangles, some small drainages coming down a fan from the northeast are right-offset, and there is a shallow linear hump visible on older aerial photography extending across the fan along the trend of the fault. These features, and the alluvial fan which hosts them, are almost certainly of Holocene age. This same fan crosses the San Felipe Valley fault several hundred meters to the northeast, but there is no apparent evidence for offset of the fan by that fault.

Farther to the southeast, within the northeastern corner of the Julian quadrangle and the northwestern corner of the Earthquake Valley quadrangle, the Earthquake Valley fault is characterized, for a distance of about 3 km, by consistent right offset of drainages and ridge spurs, and abundant hillside valleys, benches, notches, and ponded alluvium. Hart and I field checked part of this segment and observed many of these features to be very youthful in appearance--almost certainly generated during Holocene time.

Farther to the southeast, in the area just west of the upper end of Sentenac Canyon, the Earthquake Valley fault zone becomes very complex. I mapped

part of this area (shown in blue on figure 3) but there is undoubtedly much more faulting there than I have shown. Most especially, there is probably a substantial amount of imbricate thrust faulting along with the high angle strike-slip faulting. The surface features that I did see are sufficiently youthful in appearance that I have no reservations about assigning a Holocene origin to them.

The southeasternmost segment of the Earthquake Valley fault zone extends southeastward from the upper end of Sentenac Canyon for a distance of about 4 km. The fault passes through crystalline bedrock and/or older alluvium for the first kilometer to the southeast of Sentenac Canyon. It is characterized by scarps, notches, troughs, and drainages that appear to have been diverted to the right along the fault. I have not visited this specific part of the fault on the ground, but on aerial photos, it has a similar appearance to that part of the Earthquake Valley fault that lies 4 to 5 km to the northwest. Hart and I field checked the southeasternmost part of the fault (in sections 35 and 36). We saw no direct surface evidence for the location of the fault trace, but active alluvial fan building by drainages from the northeast could have buried surface features as young as early Holocene age.

San Felipe Valley fault

This fault is characterized by numerous segments of eroded and dissected scarps. There are also a few cases of drainages being right-offset at the fault. The material that is faulted, as Hart and I observed it on the ground, appears to consist only of older alluvium. There are numerous Holocene fans crossing the fault, but none of these appear to have been offset by the fault.

In general, I see no clear indication of Holocene movement. However, the fault is still quite well-defined; if there has been no Holocene offset, then there was significant offset in latest Pleistocene time.

Seismicity

Figure 2 shows the best quality earthquake epicenter data available for the Earthquake Valley region. There were two events near the northwestern end of the Earthquake Valley fault, but otherwise, there is no clear relationship between the seismicity in this region and the faults being considered in this report.

8. Conclusions

I conclude that all of the Earthquake Valley fault has been active during Holocene time except, possibly, the southeasternmost two kilometers of the fault. The southeasternmost two kilometers is also not well-defined. The fault is also poorly defined within the area that extends from the upper end of Sentenac Canyon to about two kilometers west of there.

The San Felipe Valley fault is fairly well-defined, but Holocene activity is doubtful.

9. Recommendations

I recommend that special studies zones be established along all of the Earthquake Valley fault except for the southeasternmost 2.5 km. I recommend that no zone be established along the San Felipe Valley fault.

10. Instigating geologist's name, date

Drew P. Smith

DREW P. SMITH
April 20, 1979

I agree with the recommendation to zone the Earthquake Valley fault but have some reservation as to how the discontinuous traces near Sentenac Cyn. & except for those just to the south of the Cyn, which are well defined, the traces to the north are rather obscure; discontinuous. I believe the San Felipe fault should be zoned SE of Sec. 11 (center) because of its structural relationship to the E/O Val pit and because of its probable Late Quat. activity.

EHH
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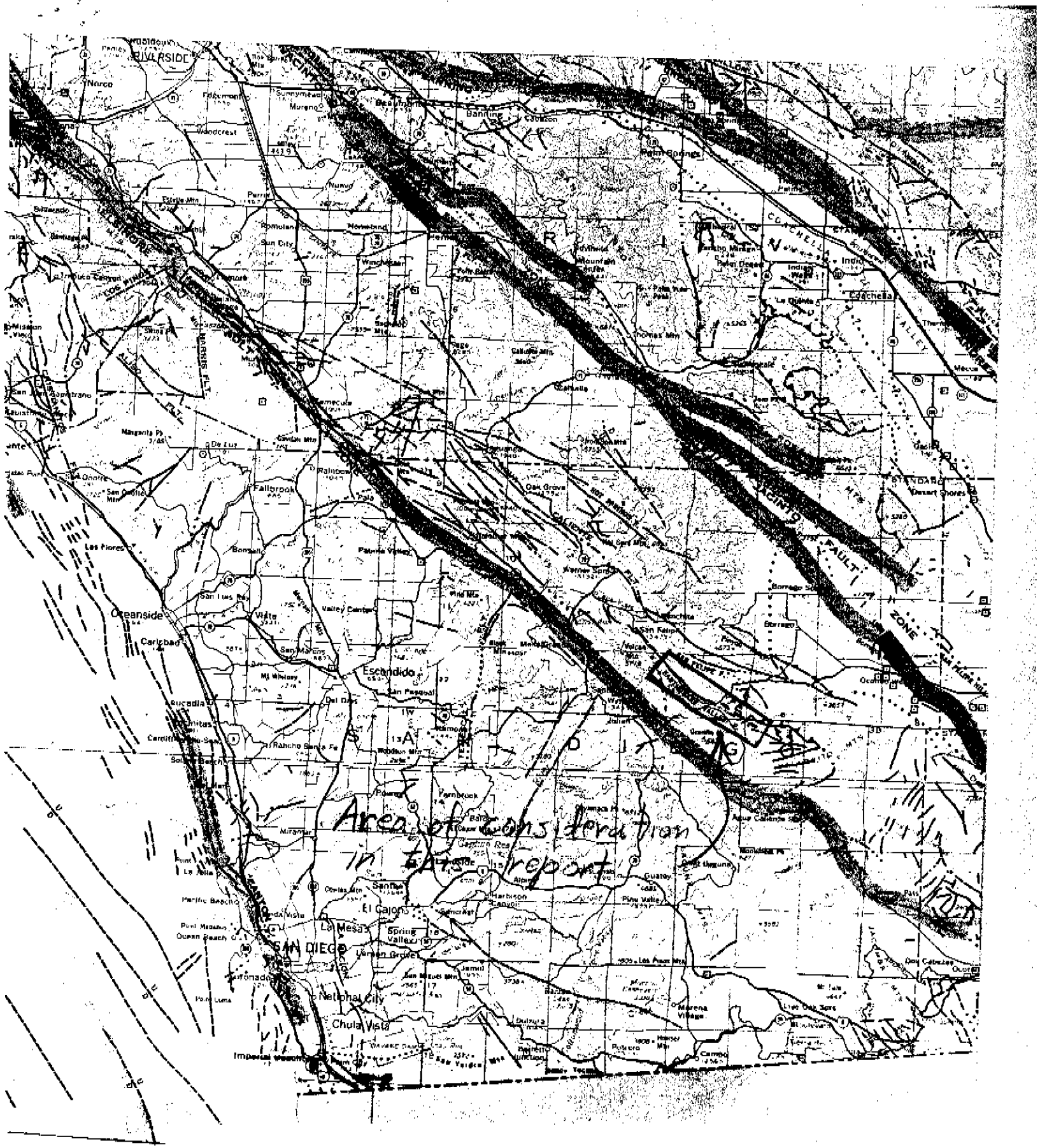

Figure 1. Index map showing the location of the Earthquake Valley and San Felipe Valley faults. Map is modified from Jennings (1975).